

(12) UK Patent Application (19) GB (11) 2 226 869 A (13)

(43) Date of A publication 11.07.1990

(21) Application No 9000061.3

(22) Date of filing 03.01.1990

(30) Priority data
(31) 295105 (32) 09.01.1989 (33) US

(71) Applicant
T.J. Gundlach Machine Company
(Incorporated in the USA - Illinois)
No. 1 Freedom Drive, Belleville, Illinois 62222,
United States of America

(72) Inventor
Theodore F Gundlach

(74) Agent and/or Address for Service
O'Brien
Hollins Chambers, 64a Bridge Street, Manchester,
M3 3BA, United Kingdom

(51) INT CL⁴
F16D 1/04

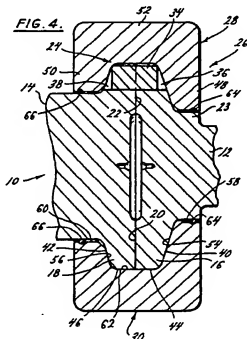
(52) UK CL (Edition K)
F2U U234 U248 U392

(56) Documents cited
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(58) Field of search
UK CL (Edition J) F2U
INT CL⁴ F16D 1/00

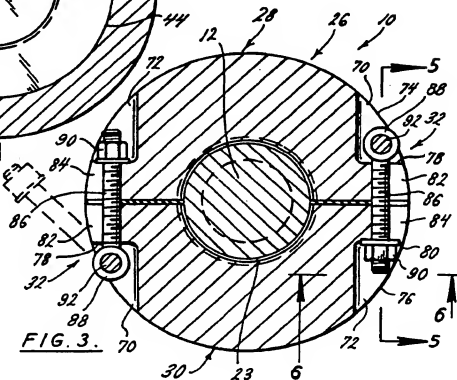
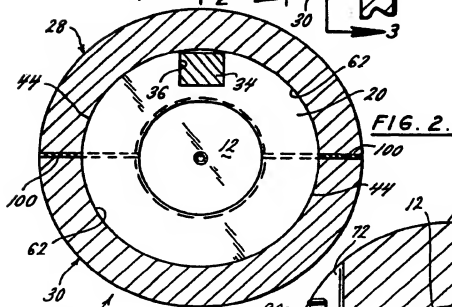
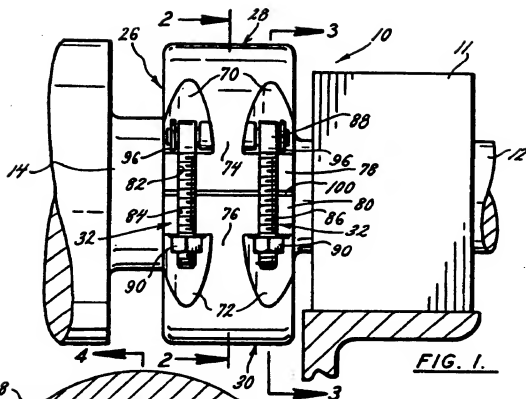
(54) Shaft coupling

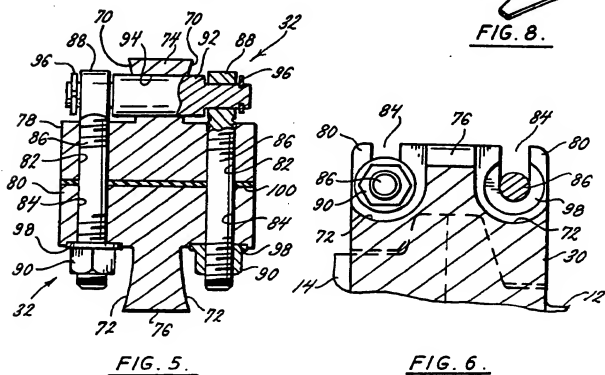
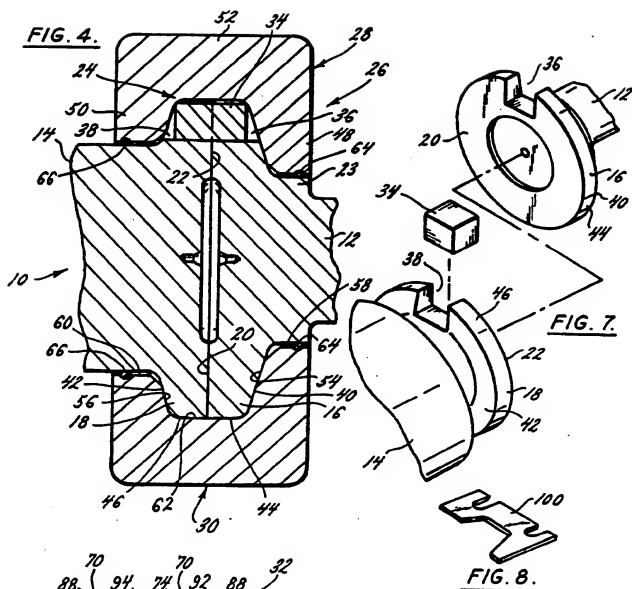
(57) This shaft coupling (10) is for connecting a first shaft (12) to a second shaft (14), each of said shafts having end flanges (16, 18), respectively, disposed in face-to-face relation. The coupling is provided with a key assembly (24) to transfer torque between the shafts, and a housing assembly to align and connect the shafts. The key assembly includes a key block (34) inserted into aligned peripherally accessible keyways (36, 38) formed in the respective flanges. The housing assembly includes a pair of semi-circular housing segments (28, 30) of generally U-shaped cross section which enclose the flanges, and diametrically opposed sets of pivotally mounted toggle bolt assemblies to facilitate quick connection and disconnection of the coupling. The housing sidewalls (48, 50) and the flange faces (40, 42) are compatibly tapered to facilitate face-to-face flange and arcuate alignment of the shafts.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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SHAFT COUPLING

This invention relates generally to shaft couplings and has particular application to couplings for transmitting torque between two connected shaft flanges and for maintaining the associated shafts in alignment.

It is particularly important in shaft couplings such as those between crusher rolls and drive shafts that an effective means of transferring torque be provided and also that means be provided for achieving and maintaining a high degree of alignment between the axes of rotation of these members. In many of the early shaft couplings, the associated shafts were provided with end flanges which had interfitted tongue and groove elements provided to transfer torque between the shafts and circumferentially spaced clamping bolts and nuts to connect the flanges together. The multiplicity of parts presented a distinct disadvantage in this type of coupling and made assembly and disassembly time consuming and difficult.

A prior patent of particular interest in this field is U.S. Patent No. 3,328,058 which is an earlier invention made by the present inventor. This patent discloses a shaft coupling for flanged shafts which utilizes circumferentially spaced shoulder bolts to transfer torque and maintain alignment and circumferentially spaced clamping bolts, intermediate the shoulder bolts, to clamp the flanges together. While this structural arrangement of parts is effective it is still necessary to remove a relatively large number of parts in order to disassemble the coupling.

Although shaft couplings are known which utilize segmental coupling sleeves overfitting and accommodating a longitudinal key extending between associated shafts, the primary was on transmitting the torque and achieving and maintaining shaft concentricity was secondary.

Embodiments of the present shaft coupler solve these and other problems in a manner not revealed by the known prior art for flanged shafts, particularly by providing an improved keying system to transmit torque between the shafts and an enclosing housing system to align and connect the shafts which requires only a small number of parts to effectuate coupling.

According to this invention generally a shaft coupling comprises a first shaft including a flange having an end face; a second shaft including a flange having an end face disposed in face-to-face relation with the end face of the first shaft flange; key means between said flanges to transfer torque between said shafts, and housing means including a plurality of housing segments enclosing said flanges and fastening means between said housing segments connecting said segments together, said housing means tending to align said shafts in the connected condition.

It is preferred to provide that the housing segments consist of a pair of generally semi-circular segments, also to further provide that the housing segments are generally U-shaped in cross section and formed to closely interfit the flanges.

Another preferred feature is to provide that the flanges each include an annular inner face, and a circumferentially extending outer face, and to provide that the housing segments include opposed sidewalls and an intermediate wall, said intermediate wall including an arcuate inner face disposed adjacent the outer faces of said flanges and said sidewalls including annular inner faces disposed adjacent associated annular inner faces of said flanges.

Still another preferred feature is to provide that the annular inner faces of the flanges and the adjacent annular faces of the housing segments are compatibly tapered tending to draw said flanges into engagement when said segments are connected.

Yet another preferred feature is to provide that the flanges of the first and second shafts are of substantially the same diameter, and the arcuate inner faces of the segments are substantially the same outer diameter as the outer faces of said flanges tending to automatically align said shafts when said arcuate inner faces of said housing segments are drawn into close juxtaposition with said outer faces of said flanges.

A further preferred feature is to provide that the key means includes a keyway provided in each flange and a key closely interfitting said keyways and extending between said flanges.

It is another preferred feature to provide that each keyway is a peripherally accessible notch formed in the flange and the key is a compatibly shaped element received by said keyways and still another aspect of the invention to provide that said keyways are generally U-shaped and said key is generally rectangular.

It is yet another preferred feature to provide that the fastening means includes toggle bolt means having one end pivotally attached to one of said housing segments and the other end engageable with an adjacent housing segment.

It is a further preferred feature to provide that the housing segments are substantially identical, and the fastening means includes opposed pairs of toggle bolt means each having one end pivotally attached to one of said segments and having the other end threaded to receive a nut engageable with the adjacent segment.

It is another preferred feature to provide that the housing segment annular sidewalls each include a remote end disposed adjacent an associated shaft portion, said housing segments being sized so that said annular wall ends are spaced from said shaft portions when said housing segment intermediate wall inner faces are engaged with the outer faces of said flanges.

It is another preferred feature to provide that the first and second shafts are of unequal diameter and the housing segment sidewalls are of unequal length; and still another aspect to provide that the first shaft includes an enlarged portion adjacent said associated sidewall.

It is a preferred feature to provide a shaft coupling which is relatively simple and inexpensive to manufacture and easy to assemble and disassemble.

Any one or more of the above preferred features is to be understood as constituting an independent aspect or aspects of this invention so far as novel and advantageous.

Specific implementation of this invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of the shaft coupling;

FIG. 2 is a cross sectional view through the housing segments taken on line 2-2 of FIG. 1;

FIG. 3 is a cross sectional view through the toggle bolt assembly taken on line 3-3 of FIG. 1;

FIG. 4 is a cross sectional view through the shaft coupling taken on line 4-4 of FIG. 2;

FIG. 5 is a fragmentary cross sectional view of the toggle bolt assembly taken on line 5-5 of FIG. 3;

FIG. 6 is a fragmentary cross sectional view of the toggle bolt assembly taken on line 6-6 of FIG. 3;

FIG. 7 is an exploded perspective view of the respective flanges notched keyways and key; and

FIG. 8 is a perspective view of the seal between the housing segments.

Referring now by reference numerals to the drawings and first to FIGS. 1 and 4, it will be understood that the shaft coupling generally indicated by numeral 10 interconnects a pair of shafts such as a drive shaft 12 and a roll hub shaft 14. The drive shaft 12, which constitutes a first shaft, is supported by a bearing 11 and includes a concentric end flange 16 and the roll hub shaft 14, which constitutes a second shaft, includes a concentric end flange 18. The flanges 16 and 18 include annular end faces 20 and 22 respectively which are

disposed in face-to-face abutting relation. In the embodiment shown, the drive shaft 12 is smaller in diameter than the hub roll shaft 14 and includes an enlarged diameter portion 23 adjacent the flange 16. The shaft coupling 10 further includes a key assembly between the flanges 16 and 18, which is generally indicated by numeral 24, and transfers torque between the drive shaft 12 and the roll hub shaft 14; and a housing assembly 26 consisting of a pair of substantially identical semi-circular housing segments 28 and 30 and toggle bolt assemblies 32 providing means for fastening said housing segments together.

More particularly, and as best shown in FIGS. 2, 4 and 7, the key assembly 24 includes a key block 34 and opposed keyways 36 and 38 in the form of U-shaped notches or recesses in each respective flange 16 and 18. As shown in Fig. 2 the key block 34 closely interfits within the keyways 36 and 38 and extends between said flanges, said keyways being of substantially identical size and peripherally accessible in the embodiment shown to simplify the shape of the key block 34 and facilitate insertion thereof into said keyways.

The flanges 16 and 18 include annular inner faces 40 and 42, respectively, and circumferentially extending outer faces 44 and 46, respectively. The outer faces 44 and 46 are of substantially the same diameter and width and the annular faces 40 and 42, although of different inside diameters, are inclined at substantially the same angle to the planar outer faces 20 and 22 of the flanges 16 and 18, respectively. The housing segments 28 and 30 enclose the flanges 16 and 18 and, in the embodiment shown, are generally U-shaped in cross section, as best shown in FIG. 4, to include opposed sidewalls 48 and 50 and an intermediate wall 52. The sidewalls 48 and 50 are defined by inclined annular faces 54 and 56 and circumferentially extending sidewall remote end faces 58 and 60, respectively. The intermediate wall 52 is defined by an

arcuate face 62. Each of the sidewall end faces 58 and 60 is grooved to receive O-ring seals 64 and 66 respectively, and said faces 58 and 60 are spaced from the associated adjacent portions of shafts 12 and 14, respectively.

As best shown in FIGS. 1 and 3, each of the housing segments 28 and 30 include recessed portions 70 and 72, which define web portions 74 and 76, respectively, and base portions 78 and 80 provided with slots 82 and 84 respectively. As shown in Figs. 3 and 5 each toggle bolt assembly 32 includes a pair of toggle bolts 86 having a ring 88 at one end and being provided with a flanged nut 90 on the other end. Each toggle bolt assembly 32 also includes a transverse pivot pin 92, each received within a bore 94 extending through each web 74. The pins have opposed reduced ends each and being received by a bolt ring 88 and each having a snap ring 96 holding said bolt in place. As shown in Figs 5 and 6, the base portion 80 includes a recessed circular portion 98 for holding the flanged nut 90, and therefor the associated toggle bolt 86, against lateral movement out of the associated slots. As will be readily understood the pivotal connection of the toggle bolts 86 to the associated housing segments and the provision of slots 82 and 84 provides that said bolts can be swung outwardly, as shown in phantom outline in Fig. 3, when the flanged nuts 90 are backed off sufficiently. Also, the threads at the ends of the bolts 86 are crushed or the bolt ends are peened to provide a means of retaining said nuts on said bolts.

In the embodiment shown, the diameters of the circumferentially extending flange outer faces 44 and 46 are substantially the same as the diameter of the circumferentially extending arcuate faces 62 of the housing segments 28 and 30. Similarly, the combined width of the said outer faces 44 and 46 is substantially the same as the width of said arcuate faces 62. The result of this close tolerance fit and the corresponding inclination of flange annular faces 40 and 42 and

associated sidewall annular faces 54 and 56, respectively, provides that when the semi-circular housing segments 28 and 30 are brought into engagement with the flanges 16 and 18, said flanges and shafts are automatically brought into axial alignment and into abutting face-to-face engagement. It will be understood that the provision of a substantial spaced relationship between the housing segment sidewalls end faces 58 and 60 and the adjacent shaft portions ensures that engagement of the housing segments and the flanges occurs before engagement between the housing segments and adjacent shaft portions. As an example, the diametrical difference between the annular housing segment sidewalls and the adjacent shaft portions could be of the order of thirty thousandths of one inch (0.030") for a shaft of four to five and one-half inches (4" to 5-1/2") in diameter.

A gasket shown in Fig. 8 is provided between the housing segments 28 and 30 on each side thereof which is configured to substantially seal the space between said segments.

It is thought that the structural features and functional advantages of this coupling 10 have become fully apparent from the foregoing description of parts not for completeness of disclosure the assembly and disassembly of the shaft coupling 10 will be briefly described.

To assemble the coupling 10, the flanges 16 and 18 are disposed in face-to-face relation, with the annular faces 20 and 22 in register and the keyways 36 and 38 in direct alignment. In this position, the key block 34 can be readily inserted into the keyway notches 36 and 38 as will be apparent from Fig. 7. Following this, the housing segments 28 and 30, with the gaskets 100 in place and the toggle bolts 86 in the outwardly pivoted position, are emplaced about the flanges 16 and 18. It will be understood that this emplacement is considerably facilitated by the tapered walls 48 and 50 of said housing segments which readily fit over the compatibly tapered

combined flanges as is illustrated by reference to Fig. 4. When this is accomplished the toggle bolts 86 can be swung into position within associated slots 82 and 84 and the flanged nuts 90 tightened so that they are seated within the recesses 98. When the tightening is completed the flange end faces 20 and 22 are drawn together and the flanges accurately and automatically rendered concentric by virtue of the engagement between the arcuate faces 62 of the two housing segments 28 and 30 and the circumferentially extending outer faces 44 and 46 of said flanges.

As will be also readily understood uncoupling of the shafts for replacement or repair, for example, of the roll hub is simply a matter of backing off the flanged nuts 90 a short distance to unseat them from the associated recesses 98, so that the bolts 86 can be swung clear at which time the housing segments 28 and 30 can readily be removed, it being understood that the flanged nuts 90 do not have to be removed and are retained by peening or by crushing the end threads thereby avoiding accidental loss of such nuts. The uncoupling is completed by removal of the key block 34 from the keyways 36 and 38 by simply tapping it with an appropriate tool such as a non-metallic hammer. It will be particularly understood from Fig. 3 that the provision of toggle bolts 86 which are pivotally connected at diametrically opposite points on each of the housing sections 28 and 30 permits these sections to be identical thereby avoiding the need for two dissimilar sections.

In view of the above it will be seen that various aspects and features of the invention are achieved and other advantageous results attained. While a preferred embodiment of the invention has been shown and described, it will be clear to those skilled in the art that changes and modifications may be made therein without departing from the invention in its broader aspect.

CLAIMS:

1. A coupling for a pair of shafts comprising:
a first shaft including a flange having an end face,
a second shaft including a flange having an end face disposed in face-to-face relation with the end face of the first shaft flange,
key means between said flanges to transfer torque between said shafts, and
housing means including a plurality of housing segments enclosing said flanges and fastening means between said housing segments connecting said segments together, said housing means tending to align said shafts in the connected condition.
2. A coupling as defined in claim 1, in which: the housing segments consist of a pair of generally semi-circular segments.
3. A coupling as defined in claim 2, in which: the housing segments are substantially identical, and the fastening means includes opposed pairs of toggle bolt means each having one end pivotally attached to one of said segments and having the other end threaded to receive a nut engageable with the adjacent segment.
4. A coupling as defined in any preceding claim, in which:
the housing segments are generally U-shaped in cross section and formed to closely interfit the flanges.
5. A coupling as defined in any preceding claim, in which:

the flanges each include an annular inner face, and a circumferentially extending outer face, and the housing segments are generally U-shaped in cross section and include opposed sidewalls and an intermediate wall, said intermediate wall including an arcuate inner face disposed adjacent the outer faces of said flanges and said sidewalls including annular inner faces disposed adjacent associated annular inner faces of said flanges.

6. A coupling as defined in claim 5, in which:
the annular inner faces of the flanges and the adjacent annular faces of the housing segments are compatibly tapered tending to draw said flanges into engagement when said segments are connected.
7. A coupling as defined in claim 5 or claim 6, in which:
the flanges of the first and second shafts are of substantially the same diameter, and
the arcuate inner faces of the segments are substantially the same diameter as the outer faces of said flanges tending to automatically align said shafts when said arcuate inner faces of said housing segments are drawn into close juxtaposition with said outer faces of said flanges.
8. A coupling as defined in claim 7, in which:
the housing segment annular sidewalls each include a remote end disposed adjacent an associated shaft portion, said housing segments being sized so that said annular wall ends are spaced from said shaft portions when said housing segment intermediate wall inner faces are engaged

with the outer faces of said flanges.

9. A coupling as defined in claim 8, in which:
the first and second shafts are of unequal
diameter and the housing segment opposed
sidewalls are of unequal length.
10. A coupling as defined in claim 9, in which:
the first shaft includes an enlarged portion
adjacent said associated sidewall.
11. A coupling as defined in any preceding claim, in
which:
the key means includes a keyway provided in each
flange and a key closely interfitting said
keyways and extending between said flanges.
12. A coupling as defined in claim 11, in which:
each keyway is a peripherally accessible notch
formed in the flange and the key is a compatibly
shaped element received by said keyways.
13. A coupling as defined in claim 12, in which:
said keyways are generally U-shaped and said key
is generally rectangular.
14. A coupling as defined in any preceding claim, in
which:
the fastening means includes toggle bolt means
having one end pivotally attached to one of said
housing segments and the other end engageable
with an adjacent housing segment.
15. A coupling for a pair of shafts substantially as
herein described with reference to and as shown
in the accompanying drawings.